Language capacities: **Is grammar special?**

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Recent studies of children with developmental disorders provide striking insights into the nature of language. These studies suggest that, although much of language arises from more general cognitive capacities, certain aspects of grammar have an autonomous psychological and neural basis.

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Some of the more heated debates in the cognitive sciences revolve around the nature of human language. Is there innate linguistic knowledge? Does language require the ability to learn and use symbolic rules, or can it be explained solely through associative capacities? And how autonomous is language — is the ability to learn to speak the result of more general social, cognitive and perceptual abilities, or is there a separate language module, instinct or organ?

One source of insight into these issues is the study of children with developmental disorders. Heather van der Lely and colleagues [1] recently presented in *Current Biology* an extensive case-study of a 10 year old boy, known as AZ, who suffers from a disorder known as specific language impairment. Specific language impairment is largely inherited, and some of AZ's family members reported that they suffered from a milder form of the same disorder. The problems that AZ have are not subtle. He speaks in short sentences, omits words and phrases — "What cat Mrs. White stroked?", "The dog was poking in" — and makes errors with agreement — "My Mum make the breakfast", "What did Mrs. Brown dropped?". He does not use complex or embedded phrases, such as "the small black dog" or "the cat with the blanket", which are common in the speech of children half his age.

Children with specific language impairment are not rare, but what makes AZ such an interesting case is that in all other regards he is either normal or better-than-normal. His articulation is fine and so is his hearing. He has an above average non-verbal IQ, and does well at problems that involve symbol manipulation, such as logical puzzles and transitive inference. He can solve analogy tasks, such as "Kipper is to fish, as cheddar is to ___". But at the same time, he fails to understand even fairly simple aspects of grammar. (This is similar to a child discussed by Gopnik and Crago [2], who has severe problems with grammar, but is a whiz at mathematics and computer programming.) As van der Lely and colleagues [1] are careful to note, there do exist children with specific language impairment who have cognitive, social, or processing deficits [3]. This might even be so for most cases of specific language impairment. Nevertheless, AZ is not unique; there are a host of other children that apparently exhibit the same dissociation between grammar and other mental processes [1].

As specific language impairment runs in families, the finding of a grammar-specific deficit is often cited in the popular press as evidence for "a gene for grammar". But this is very unlikely. Given the computational and neural complexity of human grammatical abilities, they are unlikely to be under the control of a single gene — although it might well be that it is an abnormality in a single gene that disrupts or destroys AZ's ability to use grammar [4]. A better way of looking at such a deficit is that it provides evidence for an innate specialization for grammar, precisely of the sort proposed by Noam Chomsky [5] and other modern-day nativists [4].

One reason why developmental disorders are so interesting is that they help us determine the structure of the normal mind. In the case of AZ, they support the view that grammar is distinct, not only from other aspects of symbolic reasoning (such as logic), but also from other parts of language itself. For instance, AZ knows full well that the "himself" in "Mowgli says Baboo is tickling himself" must refer to a male (knowledge of semantics), and he appreciates that pronouns in general must refer to people that participants in a conversation are familiar with (knowledge of pragmatics). But although even much younger children understand that "Mowgli says Baboo is tickling himself" must mean that Mowgli says Baboo is tickling Baboo, AZ has no understanding of this grammatical principle, and so does not make any distinction between the quite different sentences "Mowgli says Baboo is tickling himself" and "Mowgli says Baboo is tickling him".

It is interesting that AZ's problems are not limited to syntax. They extend as well to understanding simple rules of morphology that involve the construction of new words. AZ doesn't have any understanding, for instance, that you can take a new verb in the present-tense and turn it into a past-tense form by adding '-ed'. Again, this is knowledge that much younger children possess. So when told "Every day I plam at Susan. Yesterday I ___ at Susan", normal children will usually say "plammed". But AZ does not; he just parrots back the original word, "plam". AZ's problem with 'grammar', then, extends to both syntax and morphology,

though apparently not to phonology, which is the system of rules governing the sounds of words.

What about vocabulary? Some scholars who reject the notion of specifically grammatical capacities have argued that syntax learning and word learning are done through the very same general mechanism [6]. Other see a sharp distinction between the two, arguing that the module that underlies grammar acquisition is distinct from the capacities involved in word learning [4]. This raises the question of whether vocabulary is impaired along with grammar in children such as AZ. The data here are somewhat mixed. AZ was late in speaking and he does show a vocabulary impairment, though not one as severe as his grammar impairment — he has the vocabulary of a normal seven year old.

One theory that might account for this more mild deficit is that there are (at least) two mechanisms involved in normal word learning. The first involves the use of perceptual and social cues, and is most relevant for the learning of concrete nouns such as "chair" and "dog", as well as verbs such "kick" and "smile". The other involves the use of grammatical cues, and is relevant for the learning of more abstract nouns such as "story" and "game", and for verbs such as "think" and "see". It might be that AZ's impairment in word learning exists only for this second type of learning. Supporting this, there is experimental evidence that children with specific language impairment face a particular problem using syntax to learn the meanings of verbs [7].

If this first type of learning really is autonomous from grammar, then we might expect to find children who show the opposite pattern to AZ: children who have problems with vocabulary, but are grammatically normal. Some autistic children seem to fall into this group. Their production and comprehension of grammar is relatively normal [8], but they have serious problems learning concrete nouns. This is perhaps because autism involves a deficit in social cognition, and hence these children find it difficult to figure out what people are referring to when they use new words to refer to entities in the world [9]. There is a growing body of evidence from studies of normal children that word learning relies on the same systems of inference and memory that apply to the learning of social facts more generally [10]. This does not seem to be the case with grammar, however, which is why there could exist a child such as AZ who is fully normal at every type of learning — except for the learning of grammar.

Cases such as AZ pose a problem for the orthodox view in developmental psychology. Many developmentalists endorse the common sense notion that language is a by-product of general intelligence; we learn and use language because we are, in some to-be-specified way, just plain smart. From an evolutionary perspective, it is argued that, while other animals have evolved dedicated modules or instincts, the unique thing about humans is our plasticity. As Karmiloff-Smith [11] puts it, evolution has "made the human neocortex increasingly flexible and open to learning during postnatal development". Domain-specific deficits might exist, under this view, but they must emerge from more general difficulties in perception and cognition, not from damage to genetically-specified modules.

The alternative is that there is no sharp discontinuity between humans and other animals — like many other animals, we have evolved a specialized communication system, one that is distinct from other aspects of cognition, and which can be selectively impaired [12]. Exploring this alternative through the study of developmental disorders has the promise of informing us about the structure of the human mind, and potentially about its neural and genetic foundations.

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